PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-070566

(43)Date of publication of application : 10.03.1998

(51)Int.Cl. H04L 12/46
H04L 12/28
H04L 12/66
H04L 29/08

(21)Application number : 08-227970

(22)Date of filing : 29.08.1996

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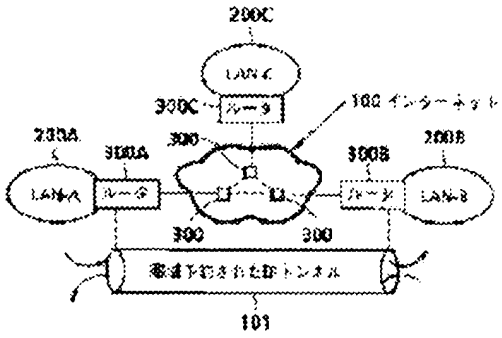
(54) BAND SECURING TYPE VPN CONSTRUCTING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To secure VPN(virtual private network) by the unit of a host or a sub-net.

SOLUTION: An IP tunnel 101 is constituted between routers 300A and 300B connected to internet 100 and a network resource reserving type protocol is started on this IP tunnel 101 to reserve the transmitting band width of the IP tunnel 101 to secure the band of VPN by the unit of the host to the sub-net. In addition, as the traffic control of routers 300A, 300 and 300B on the IP tunnel 101, the sending frequency of a packet which an inputting processor and an outputting processor within each router process is assigned by the ratio of a transmission band width reserved to the IP tunnel to simplify the algorithm of traffic control. In addition, each router 300A, 300 and 300B on the IP tunnel is provided with a reserving schedule function to manage the using time of band securing type VPN to secure a band at a designation date.



LEGAL STATUS

[Date of request for examination]	06.02.2003
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3591996
[Date of registration]	03.09.2004
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The band secured mold VPN construction approach characterized by reserving transmission band width of face of this IP tunnel by constituting IP tunnel between the routers connected to the Internet, and starting a network resource reservation mold protocol on this IP tunnel.
[Claim 2] The band secured mold VPN construction approach according to claim 1 characterized by assigning the sending-out frequency of the packet which the input processor and output processor inside this router process as traffic control of the router on IP tunnel by the ratio of the transmission band width of face reserved to each IP tunnel.
[Claim 3] The band secured mold VPN construction approach according to claim 1 or 2 characterized by giving a reservation schedule function to each router on IP tunnel, and managing the time of the band secured mold VPN.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention enables reservation or reservation of a request of transmission band width of face per a host unit or subnet especially about the approach of building VPN (brief sketch display of Virtual Private Network (virtual private network: virtual dedicated network)), on the Internet (Internet).
[0002]
[Description of the Prior Art] VPN is network [which established the structure which constitutes a logical group from on public networks, such as the Internet, and maintains closed **** among the group].
[0003] Many and unspecified users have usually connected with public networks, such as the Internet. Therefore, fundamentally, only a specific user's communication link cannot be performed but has a problem on the security that unjust access by the third party is not avoided.
[0004] Then, by giving security countermeasures by End-End (and - end) in recent years, a dedicated line is virtually built on the Internet and the VPN technique used as a basic trunk of connection between LANs (brief sketch display of Local Area Network) attracts attention.
[0005] By the conventional VPN, after giving security, such as - and a data encryption which comes out, user authentication, and an access control, between specific bases is connected through the Internet, and specifically, the group with closed **** is offered.
[0006] By realizing such VPN on a public network, only a specific user's communication link is attained and the Internet etc. can be used as an imagination dedicated network. However, the conventional VPN has not guaranteed network resources (network resource), such as a band, on the specification.
[0007] That is, since bandwidth is changed in response to the effect of other traffic unlike an original dedicated line, the conventional VPN has the problem of being hard to predict a communication link property.
[0008] On the other hand, RSVP (brief sketch of Resource Reservation Protocol) which is the network resource reservation mold protocol which thought QoS (the brief-sketch display of Quality of Service: qualities of service, such as a band, delay, and fluctuation) as important is proposed.
[0009] the host (terminal) 201 of specific LANs 200A and 200B specifically connected to the Internet 100 as shown in drawing 7 -- all -- a list -- the routers 300A, 300, and 300B between LAN200A and 200B -- all are made to support RSVP per application Notation R expresses the support of RSVP among drawing 7 .
[0010] And the network resource which fills a specific quality of service, for example, specific bandwidth, is required, reserved and secured in a network by RSVP for each application of every. That is, conventionally, it is an end-end and the network resource is reserved per application by RSVP.
[0011] Since termination will incidentally be carried out with the routers 300A and 300B of ends even if it makes only Routers 300A, 300, and 300B support RSVP per application as shown in drawing 8 , the application 202 on RSVP is not connected to both LANs 200A and 200B.

[0012] Now, although it can think that the band of VPN is securable if RSVP is combined with the conventional VPN, there is a problem of following (1) and (2) actually.
(1) Since a network resource (for example, band) is conventionally secured at an end-end by RSVP, all the hosts of existing linked to VPN have to support RSVP.
(2) If it sees from a viewpoint of the current VPN utilization approach, management of a host unit and a subnet unit is desired rather than an application unit in many cases, and, in such a case, band reservation in the conventional application unit is not suitable. In addition, a subnet will be the network created by dividing the host section of an IP address further (network section and host section), and if it says in drawing 7 or drawing 8 , it will be the network which subdivided LANs 200A and 200B.
[0013]
[Problem(s) to be Solved by the Invention] This invention aims at offering the approach of building the band secured mold VPN which can secure transmission band width of face per a host unit or subnet, in view of the above-mentioned trouble.
[0014]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the band secured mold VPN construction approach of this invention constitutes IP tunnel between the routers connected to the Internet, and is characterized by reserving transmission band width of face of this IP tunnel by starting a network resource reservation mold protocol on this IP tunnel.
[0015] Moreover, the band secured mold VPN construction approach of this invention is characterized by assigning the sending-out frequency of the packet which the input processor and output processor inside this router process as traffic control of the router on IP tunnel by the ratio of the transmission band width of face reserved to each IP tunnel in addition to the above.
[0016] Furthermore, in addition to the above, other band secured mold VPN construction approaches of this invention give a reservation schedule function to each router on IP tunnel, and are characterized by managing the time of the band secured mold VPN.
[0017]
[Embodiment of the Invention]
(Principle of invention) Next, with reference to drawing 9 (a), (b), and drawing 10 , the principle of the band secured mold VPN construction approach concerning this invention is explained.
[0018] The IP tunnel 101 consists of examples shown in drawing 9 (a) between router 300A connected to the Internet 100, and 300B. Here, IP is the brief sketch display of Internet Protocol (Internet Protocol). Moreover, it is the section when the packet constituted by adding IP header the IP address of Routers 300A and 300B (the starting point and the terminal point of the IP tunnel 101) etc. was described to be to the original packet (capsulation) exists like common knowledge in the IP tunnel 101. IP header added to reverse is removed with a terminal router, for example, 300B.
[0019] Therefore, the IP tunnel 101 serves as VPN for LANs 200A and 200B by letting all the traffic between network (drawing 9 LAN) 200A in which the routers 300A and 300B of ends carry out a group, respectively, and 200B pass to the IP tunnel 101.
[0020] Each routers 300A, 300, and 300B on such IP tunnel 101 are made to support RSVP (network resource reservation mold protocol), and RSVP is started on the IP tunnel 101. Consequently, since the band reservation by RSVP is performed between the IP tunnels 101, i.e., a router, it is possible to use the network resource (for example, band) which both LAN200A and the application 202 on 200B were encapsulated at the starting point of IP tunnel, and was secured on the IP tunnel 101 as data of the application corresponding to RSVP among router 300A - 300B. Here, as shown in drawing 9 (b), the IP tunnel 101 section should just be located in the range including the band secured section (this example the router 300 between A - 300B) 102 of RSVP. That is, transmission band width of face can be reserved every IP tunnel 101. Moreover, reservation of transmission band width of face is performed per not the conventional application unit but each host unit on each LAN200A and 200B, or subnet. It becomes unnecessary furthermore, for each host 201 to support RSVP.
[0021] Moreover, what is necessary is just to transmit a discharge message with a RSVP protocol to other routers 300 and 300B (or 300 and 300A) from router 300A (or 300B) of the end of the IP tunnel

101, in order to cancel reservation of transmission band width of face.
[0022] Thus, since reservation of transmission band width of face is performed on a RSVP protocol, it is possible for it not to be necessary to change the parameter of each node manually, to be able to reduce human cost, and to assign bandwidth promptly and flexibly to short-term band need. Moreover, discharge of band reservation is also easy.
[0023] As mentioned above, by combining the IP tunnel 101 and a network resource reservation mold protocol (RSVP), it cannot be influenced of other traffic but VPN in which band reservation of host 201 unit or a subnet unit is possible can be built.
[0024] By the way, although RSVP is a protocol which performs reservation and establishment of a network resource, nothing is specified about the concrete control approach for guaranteeing QoS (a band, delay, fluctuation, etc.) in a router or a host. Therefore, it depends for the QoS guarantee in a network on mounting of the traffic control of a router or a switch greatly. WFQ (Weighted Fair Queueing) reported as an algorithm of a packet or scheduling determines a priority according to the traffic property of application, controls a band and delay characteristics, and is a complicated algorithm.
[0025] since only transmission band width of face is reserved as a network resource parameter every IP tunnel 101 in this example -- the control for a band guarantee -- the above -- it can respond not with a complicated algorithm but with the algorithm of simple packet scheduling as shown in drawing 10 . The traffic control of each routers 300A and 300,300B on the IP tunnel 101 simplifies extremely by using the algorithm of assigning the number of packets especially processed by the input processor and output processor inside each router 300A and 300,300B by the ratio of the transmission band width of face reserved to each IP tunnel 101.
[0026] In the case of drawing 10 , the packet scheduler 401, two or more buffers 402 for RSVP (for IP tunnel) of #1 to #n, and the buffer 403 for non-RSVP perform packet scheduling. That is, since the band between the routers of adjoining arbitration is classified into the part of two or more IP tunnels, and the other (non-IP tunnel) part, the buffer tooth space in a router is similarly divided into two or more buffers 402 for RSVP, and the buffer 403 for non-RSVP. In IP tunnel, since it is not necessary to specify application, it is assumed that the packet which reaches each buffer 402 for RSVP has the same traffic property distribution. And an algorithm is simplified by distributing the packet sending-out frequency from each buffer 402 for RSVP by the buffer size and the packet scheduler 401 of each buffer 402 for RSVP by the ratio of the transmission band width of face reserved to each IP tunnel.
[0027] In addition, packet sending out from the buffer 403 for non-RSVP makes a priority low, such as carrying out, when there is no packet in the buffer 402 for RSVP.
[0028] Furthermore, originally, by reservation of the network resource using RSVP, only when a network resource is needed, it reserves. However, by giving a reservation schedule function to each routers 300A and 300,300B on the IP tunnel 101, and managing the time of the band secured mold VPN, the conventional RSVP can be extended, time can be specified and transmission band width of face can be reserved.
[0029] (Example) Next, the example of this invention is explained with reference to drawing 1 - drawing 6 . Drawing 1 shows the network model which applied this invention. Drawing 2 shows the example of a configuration of the traffic control inside a router, and drawing 3 shows the traffic control procedure in the configuration of drawing 2 . Drawing 4 is the explanatory view of the packet queuing in traffic control. Drawing 5 and drawing 6 show the procedure (the 1, its 2) of the VPN reservation schedule in a router.
[0030] In the network model of drawing 1 , three LANs 200A, 200B, and 200C are connected to the Internet 100 through the routers 300A, 300B, and 300C which supported RSVP. The router 300 of the Internet 100 is also supporting RSVP. And between two routers each 300A and 300B, between 300B and 300C, IP tunnel (only 101 is shown by a diagram) is set up between 300C and 300A, respectively. All the traffic between LAN200A and 200B the IP tunnel 101 Through, All the traffic between LAN200B and 200C has let IP tunnel (graphic display abbreviation) where all the traffic between through, LAN200C, and 200A also corresponds corresponding IP tunnel (graphic display abbreviation) pass.

[0031] Setting out of such IP tunnel 101 is performed by adding IP tunnel function only on the machine (IP tunnel server) of IP tunnel ends. That is, it is carried out when the router of IP tunnel end, for example, 300A, requires setting out of IP tunnel from the router of the other end, for example, 300B. As mentioned above, since capsulation (or capsule discharge) of the IP packet by IP tunnel starting point (or terminal point) should just be performed in the range including the band secured section (102 reference of drawing 9) by RSVP, as it thinks also when the provider (for example, communication link entrepreneur) of a transmission band performs addition of IP tunnel function, and shown in drawing 9 (b), the user of a transmission band may set up by IP tunnel server 203 on LAN200A and 200B.
[0032] In addition, in this example, between two LANeach200A, between [200B] and 200B, between 200C and 200C, and 200A is connected through the Internet 100, after giving security, such as end - and a data encryption which comes out, user authentication, and an access control, like the conventional VPN, respectively.
[0033] The interior of a router is considered as the configuration shown in drawing 2 for traffic control. Generally, since a router has two or more interfaces in an input side and an output side, this example explains as a thing with the interface of two both sides.
[0034] Then, inside a router, the number of IP tunnels (beforehand divisor), the input buffer 301 for RSVP of a same number N individual, and one input buffer 302 for non-RSVP (for non-reserving mold packets) are created by the input side in the process of the band reservation by the network resource reservation mold protocol (RSVP) before data transmission. Moreover, one output buffer 304 for non-RSVP (for non-reserving mold packets) is created by the output side for every output interface with the output buffer 303 for RSVP of the L+M individual more than the number of IP tunnels (beforehand divisor). However, each buffer capacity shall be adjustable according to the transmission band width of face reserved to each IP tunnel.
[0035] Furthermore, in addition to the processor 305 for an input, and the processor 306 for an output for every output interface, the reservation database 308 which cooperates with the processor 307 for reservation discernment to this is formed in the interior of a router. Data required for discernment, collating, and a check of the existence of band reservation and each contents of reservation (** / receiving-side IP address, a Port (port) number, Protocol ID, reservation bandwidth, etc.) are stored in the reservation database 308. 311 show the packet which added the IP header 310 the IP address of the router of IP tunnel ends etc. was described to be by the original packet (IP datagram) 309 (capsulation) among drawing 2 .
[0036] Fundamentally, in order to reserve transmission band width of face to IP tunnel, when the host or subnet on LAN needs a transmission band, the demand of the transmission band reservation of this host or a subnet to the router of the end of the RSVP band secured section is notified, and the contents of reservation, such as ** / receiving-side IP address on IP tunnel, a port number, Protocol ID, and reservation bandwidth, are notified. This router transmits these advice to an intermediate router and the router of IP tunnel other end one after another by RSVP. Each router stores band reservation and its content in the reservation database 308. With one of routers, if band reservation is impossible, RSVP will notify the purport which rejects the demand of band reservation to the router of the starting point.
[0037] Next, if the traffic control in a router is explained with reference to drawing 2 and drawing 3 , and drawing 4 , it will become like following the (1) - (5).
[0038] (1) Like steps S1 and S2 of drawing 3 , the processor 307 for reservation discernment performs discernment, collating, and a check of the existence of band reservation, and each contents of reservation (** / receiving-side IP address, a port number, Protocol ID, reservation bandwidth, etc.) with reference to the reservation database 308 which cooperates to it to the packet which reached each input interface.
[0039] (2) The processor 307 for reservation discernment assigns a packet to the input buffer corresponding to IP tunnel reserved respectively after the existence of these band reservation, discernment of each content of reservation, etc. (step S3 of drawing 3).
[0040] (3) In the case of packet message distribution processing, the input processor 305 takes out a packet from an input buffer with a high priority (step S4 of drawing 3). If drawing 4 is explained to an example, specifically, it will become like the following ****.

** As now shown in drawing 4 , three pieces, the input buffer 301#1 for RSVP (for band reservation), #2, and #3, and the input buffer 302 for non-RSVP (for non-reserving mold packets) presuppose that the ratio of those with one piece, the reservation bandwidth of each IP tunnel, and non-reserving mold bandwidth is i:j:k:x.
** The input processor 305 is the frequency fm according to each bandwidth ratio. Each input buffer is accessed and a packet is taken out from this buffer. Specifically, it is the frequency where it is expressed with fm =m/(i+j+k+x). However, m is in any of i, j, and kx. thus, the object for RSVP -- if there is no packet which should be taken out when input-buffer #1, #2, and #3 are accessed, the packet in the input buffer 302 for non-RSVP will be taken out if a packet is there.
[0041] (4) After packet fetch processing from the above-mentioned input buffer, the input processor 305 sends a packet to a corresponding output buffer (step S5 of drawing 3).
[0042] (5) The output processor 306 prepared for every interface sends out the packet in an output buffer to ejection and a network after that (steps S6 and S7 of drawing 3 R> 3). The function in which an output processor 306 takes out the packet in an output buffer is the same as that of the above (3) only by reading the input processor 305 as an output processor 306, and reading input-buffer #1-#3 as output-buffer #1-#3, and becomes like the following ****.
** As now shown in drawing 4 , three pieces, the output buffer 303#1 for RSVP (for band reservation), #2, and #3, and the input buffer 304 for non-RSVP (for non-reserving mold packets) presuppose that the ratio of those with one piece, the reservation bandwidth of each IP tunnel, and non-reserving mold bandwidth is i:j:k:x.
** An output processor 306 is the frequency fm according to each bandwidth ratio. Each output buffer is accessed and a packet is taken out from this buffer. Specifically, it is the frequency where it is expressed with fm =m/(i+j+k+x). However, m is in any of i, j, and kx. thus, the object for RSVP -- if there is no packet which should be taken out when output-buffer #1, #2, and #3 are accessed, the packet in the output buffer 304 for non-RSVP will be taken out if a packet is there.
[0043] Next, the reservation schedule function of VPN is explained with reference to drawing 5 and drawing 6 . Although reservation of a transmission band can originally be made in the network resource reservation which used RSVP like the above-mentioned only when a resource is needed, reservation of the transmission band in the specified time is enabled by processing of following (I) - (V) in this example. In addition, step S28 of drawing 5 follows step S29 of drawing 6 .
[0044] (I) If prior reservation of a band secured mold VPN activity arises (step S21 of drawing 5), it will check whether the path for IP tunnel can be set up by RSVP (network resource reservation mold protocol) (step S22 of drawing 5). Prior reservation will be rejected if setting out is impossible (steps S23 and S24 of drawing 5).
[0045] (II) If setting out is possible, with reference to the reservation database in all the routers on the path for IP tunnel (308 reference of drawing 2), it will check whether the transmission band width of face required of the time concerned is securable (steps S23 and S25 of drawing 5). Prior reservation will be rejected if reservation is impossible (steps S26 and S24 of drawing 5).
[0046] (III) When it can secure, reservation information (time, reservation bandwidth, ** / receiving-side IP address, a port number, protocol ID, etc.) required for the reservation database in all the routers on the path for IP tunnel is registered (steps S26 and S27 of drawing 5).
[0047] (IV) If it becomes assignment time, the following ** - ** will be processed and offer of the reserved transmission band width of face will be started (step S31 of step S28 of drawing 5 R> 5 - drawing 6).
** When it is judged that there is no traffic from a subscriber after carrying out fixed time supervision. reject the prior reservation (steps S28 and S24 of drawing 5).
** When the lack of a band by the traffic (traffic outside a schedule) which is not reserved in advance arises, the classification of the traffic outside the schedule performs traffic control by processing of (a) and (b) below (steps S29 and S30 of drawing 6).
(a) When the traffic outside a schedule is a non-RSVP protocol (non-network resource reservation mold protocol), reject all these traffic.

(b) When the traffic outside a schedule is a RSVP protocol, send out the message of the purport of reservation discharge to the user of that, and cancel reservation.
[0048] (V) If assignment time passes, offer of the reserved transmission band width of face will be ended (step S32 of drawing 6).
[0049]
[Effect of the Invention] Since transmission band width of face of this IP tunnel is reserved by constituting IP tunnel between the routers connected to the Internet, and starting a network resource reservation mold protocol on this IP tunnel according to this invention, the effect of other traffic can be avoided and the traffic property stabilized rather than the conventional VPN is acquired. Moreover, since the band reservation by the network resource reservation mold protocol is performed between routers (IP tunnel), reservation of the network resource for every application does not need to become unnecessary, and not each host or subnet on LAN needs to support a network resource reservation mold protocol. Furthermore, since band reservation is performed by the network resource reservation mold protocol, setting out and discharge of band reservation are easy. Therefore, it is not necessary to change the parameter of each node manually, and human cost can be reduced. Moreover, it is very effective, when transmission band width of face can be assigned promptly and flexibly to short-term band need and data transmission mass by short utilization is needed.
[0050] Moreover, according to this invention, the algorithm of traffic control simplifies extremely by assigning the packet sending-out frequency which the input processor and output processor inside this router process as traffic control of the router on IP tunnel by the ratio of the transmission band width of face reserved to each IP tunnel.
[0051] Furthermore, according to this invention, by the reservation using a network resource reservation mold protocol, what can be reserved only when a network resource is originally needed can secure the transmission band width of face in the specified future time by giving a reservation schedule function to each router on IP tunnel, and managing the time of the band secured mold VPN.

[Translation done.],

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the network model which applied this invention.
[Drawing 2] Drawing showing the example of a configuration of the traffic control inside a router.
[Drawing 3] Drawing showing the traffic control procedure in the configuration of drawing 2 .
[Drawing 4] The explanatory view of the packet queuing in traffic control.
[Drawing 5] Drawing showing the procedure (the 1) of the VPN reservation schedule in a router.
[Drawing 6] Drawing showing the procedure (the 2) of the VPN reservation schedule in a router.
[Drawing 7] Drawing showing the conventional RSVP.
[Drawing 8] Drawing showing the fault of the conventional RSVP in case the host of LAN does not support RSVP.
[Drawing 9] Drawing showing the principle of this invention.
[Drawing 10] The explanatory view of the algorithm simplification of packet scheduling.
[Description of Notations]
100 Internet
101 IP Tunnel
102 Band Secured Section by RSVP
200A, 200B, 200C LAN
201 Host
202 Application
203 IP Tunnel Server
300A, 300B, 300C, 300 Router
301 Input Buffer for RSVP
302 Input Buffer for Non-RSVP
303 Output Buffer for RSVP
304 Output Buffer for Non-RSVP
305 Input Processor
306 Output Processor
307 Processor for Reservation Discernment
308 Reservation Database
309 IP Datagram
310 IP Header
401 Packet Scheduler
402 Buffer for RSVP (for IP Tunnel)
403 Buffer for Non-RSVP

[Translation done.]

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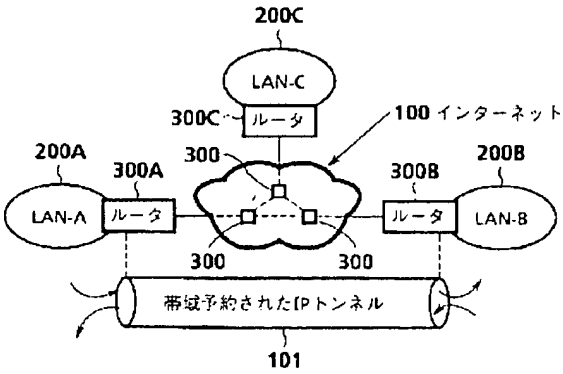
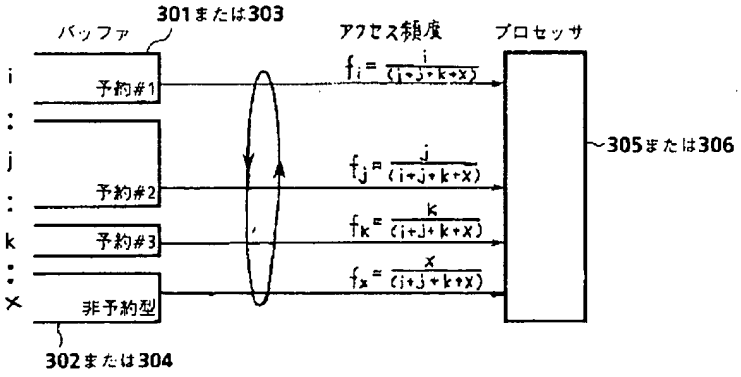
3.In the drawings, any words are not translated.

DRAWINGS

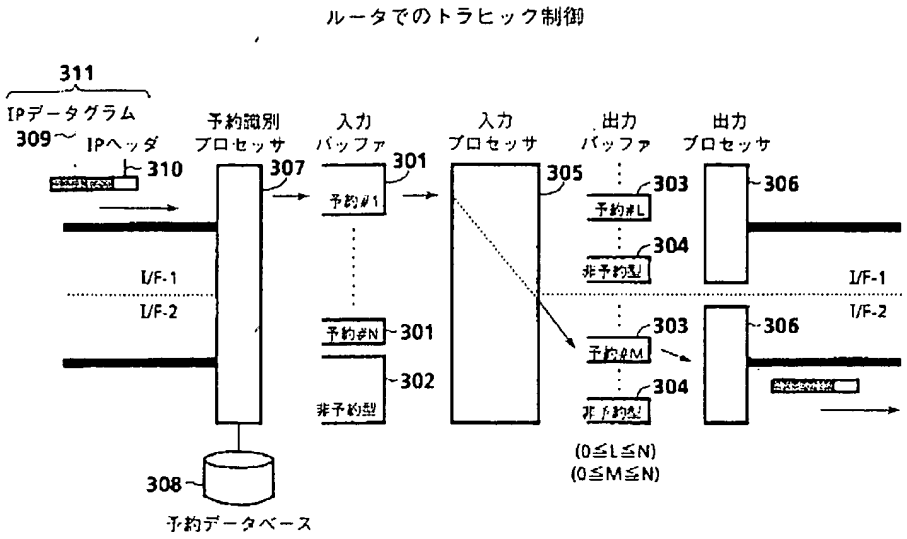
[Drawing 1]
ネットワークモデル(実施例)



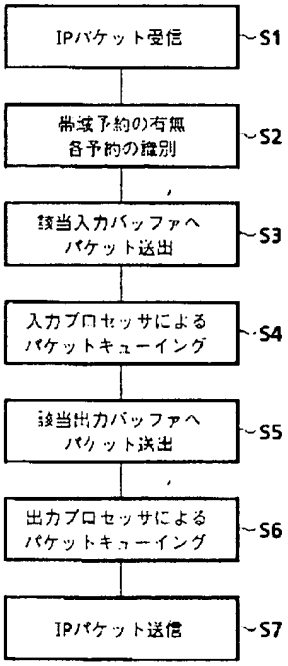
[Drawing 4]
パケットキューイング



[Drawing 2]

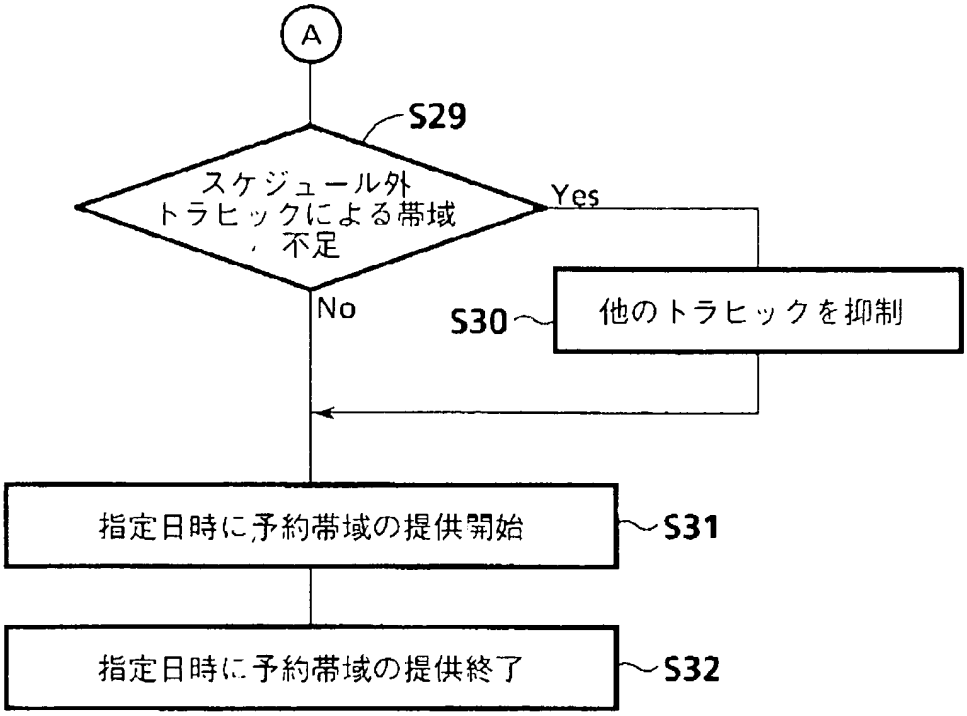


[Drawing 3]
実施例(ルータにおけるトラヒック制御)



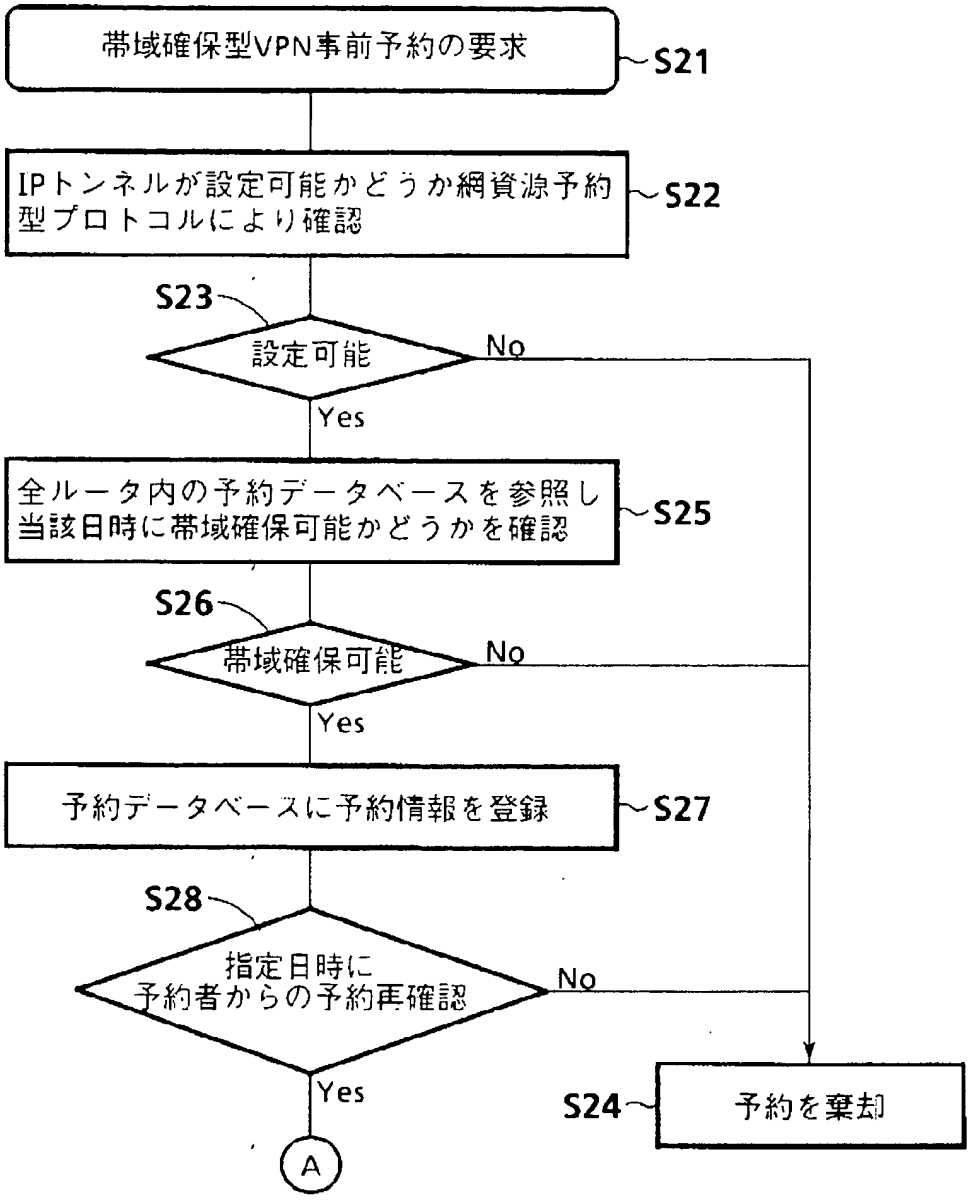
[Drawing 6]

VPNの予約スケジュール機能(その2)

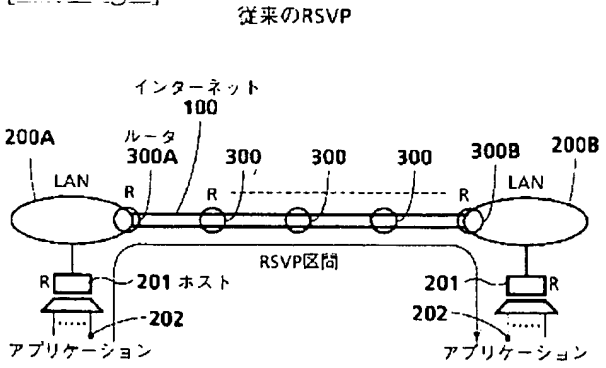


[Drawing 5]

VPNの予約スケジュール機能 (その1)

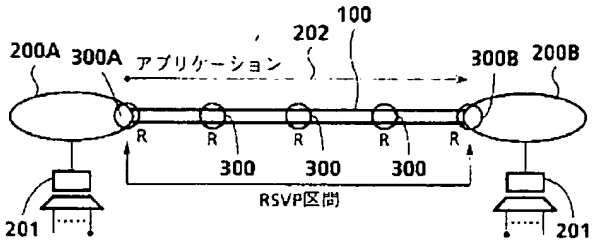


[Drawing 7]



[Drawing 8]

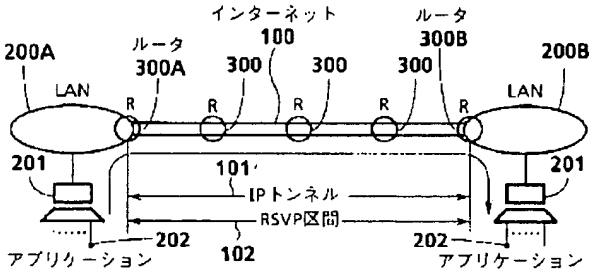
従 来



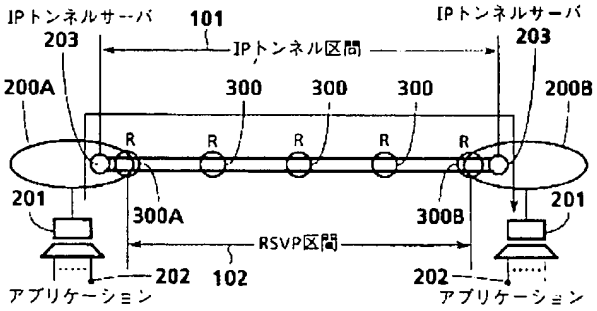
[Drawing 9]

発 明 (原 理)

(a)

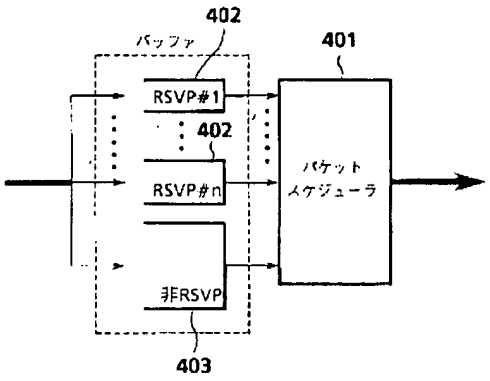


(b)



[Drawing 10]

発明(パケットスケジューリング)



[Translation done.]